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(54) CATALYTIC COMPLEX CONSTITUTED OF PHOSPHOROUS, SILICATE AND ALUMINUM OXIDE AMORPHOUS SOLID SOLUTION

(57)Abstract:

PURPOSE: To obtain a catalyst and to provide its manufacturing method, where the catalyst is constituted of a phosphorous, silicate, and aluminum oxide amorphous solid solution used for hydrocarbon conversion processes by hydrogenation decomposition, alkylation, isomerism, or the like, and is able to operate the reaction at high yields.

CONSTITUTION: This catalyst complex is constituted of an amorphous solid solution of phosphorus, silicate and aluminum oxide containing 5-50 wt.% Al₂O₃, 10-90 wt.% SiO₂ and 5-40 wt.% P₂O₅. The method of its manufacturing is constituted of a process arranging gelation of a mixture of aluminum hydrosol, silica hydrosol and a phosphorus compound, and forming particles by sintering the gel.

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CLAIMS

[Claim(s)]

[Claim 1]Phosphorus containing 5 to 50% of the weight of aluminum₂O₃, 10 to 90% of the weight of SiO₂, and 5 to 40% of the weight of P₂O₅, silicon, and a catalyst complex which comprises an amorphous solid solution of an aluminum oxide.

[Claim 2]A complex of claim 1 whose volume of a hole an average diameter has 30 to about 200-Å hole in a complex, and surface area is 0.35-0.75 cc/g in 200-about 420-m²/g.

[Claim 3]A complex of claim 1 which is having one or more metal in which a complex is chosen from a group who comprises the group VIB and VIII metal of the periodic table on it, and a mixture of those distributed.

[Claim 4]A complex of claim 3 in which group VIB metal of the mixture exists with tungsten by 0.1 to 3% of the weight of concentration of the complex, and group VII metal of a mixture exists with nickel by 1 to 20% of the weight of concentration of a composite.

[Claim 5]A mixture of alumina hydrosol, silica hydrosol, and a phosphorus compound is created, A process for preparing claim 1 or a catalyst constituent given in 2 which comprises a step which gels the mixture in order to create particles, builds phosphorus, silicon, and an aluminum oxide, and calcines those particles to a sake.

[Claim 6]This joint mixture is distributed all over an oil bath under conditions required in order that a gelling step may combine this mixture with a gelling agent and may gel an oil droplet to particles, A process of claim 7 performed by calcining the particle in order to acquire the shape of a ball which comprises phosphorus, silicon, and an amorphous solid solution of an aluminum oxide.

[Claim 7]Claim 5 in which this gelling agent is a hexaethylene tetramine or urea, or a process given in 6.

[Claim 8]A process of claim 5 performed because this gelling step carries out spray drying of the mixture.

[Claim 9]A hydrocarbon conversion process which comprises contacting hydrocarbon to one catalyst constituent [some] of claims 1-4 under hydrocarbon conversion conditions.

[Claim 10]A process of claim 9 that this hydrocarbon conversion process is hydrocracking or

alkylation.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]The catalysts of this invention are phosphorus, silicic acid, and an aluminum oxide amorphous solid solution. This catalyst can be prepared by mixing a phosphorus compound with alumina for the hydrosol of silica, gelling that mixture, building particles, performing calcining finally, and creating an amorphous catalyst. It is possible to distribute to remain as it is, to distribute metal on it, and to use this catalyst as a catalyst in various hydrocarbon conversion processes, such as hydrocracking or alkylation, at the end.

[0002]

[Description of the Prior Art]Alumina is the catalyst supporter and catalyst which were known well. It is known well that the attribute of alumina can be gelled with silica and it can change by building silica/alumina composite, or incorporating phosphorus and building alumina / phosphorus complex etc. When such refining alumina achieves the catalysis of various hydrocarbon conversion processes, such as hydrocracking, isomerization, and alkylation, it is useful. There are some methods of preparing these substances as shown below also by a Prior art. U.S. Pat. No. 3,909,450 mixes the sol of silica with alumina, gels it by a well-known oil droplet method, and is indicating about the method of preparation of the amorphous silica / alumina constituent which dries at the end and builds the constituent. Silica / alumina constituent can be prepared also by an eutectoid which is stated to U.S. Pat. No. 3,274,124. U.S. Pat. No. 4,629,717 and U.S. Pat. No. 4,727,209 have described the hydrocarbon conversion process which used phosphorus refining alumina composite and its complex. This complex is amorphous, the range of the mole ratio of phosphorus and aluminum is 1:1 to 1:100, and surface area is the range of 140-450m²/g. U.S. Pat. No. 4,760,040 is indicating the hydrocarbon degradation catalyst made with the crystalline aluminosilicate zeolite within a phosphorus content alumina matrix. Similarly, U.S. Pat. No. 4,243,556 is a constituent containing silica and alumina, and the alumina is indicated about sodium, manganese, and the constituent that are chosen from phosphorus and that is promoted with one element or a compound at least. U.S. Pat. No. 4,158,621 has described the catalyst which alumina aluminum phosphorate silica matrices are consisted of, and is made amorphous by 500 ** and

calcining of 16 hours. The catalyst for purifying the hydrocarbon made into the Japanese Patent Gazette in the supporter by which phosphoric acid is distributed on it including silica/alumina is indicated. Finally, JP,60-18509,A is indicating about the catalyst which is a mixture of P_2O_5 , and silica/alumina.

[0003]In contrast with such advanced technology, the catalyst constituent which comprises an amorphous solid solution (amorphous silica / alumina / phosphorus is called hereafter) of phosphorus, aluminum, and a silicon oxide was prepared. Generally, the solid solution means the liquid phase which only contains two or more ingredients. The solid solution of one kind is a substitutional solid solution by which the solute atom or the atom group is replaced by the solvent atom or the atom group within the crystal structure. The substitution with other things of one atom or an atom group is possible only when the size of a substitution substance does not change so much. Therefore, in this system, phosphorus and a silicon atom were replaced and aluminium atoms occupy the place. Clearly, this differs from the system in which phosphoric acid or other phosphorus compounds were built into alumina, the silica / alumina substrate, or the supporter. It differs also from JP,60-18509,A in that it is said that P_2O_5 phase mixed with silica/alumina powder does not exist. The characteristic of this catalyst constituent differs also from the quality of a mixture described with the advanced technology. For example, in the conventional catalyst, it is dependent on existence of the free phosphorus on a catalyst to depending for the acidity of this catalyst on the quantity of the silica which exists in a constituent. The porosity of this catalyst is controlled by the polymer packing under gelling of a catalyst particle.

[0004]

[Problem(s) to be Solved by the Invention]This invention relates to the process for preparing a catalyst constituent and its constituent, and the constituent using the constituent. Therefore, one example of this invention is the catalyst constituent which comprised an amorphous solid solution of the phosphorus containing 5 to 50% of the weight of aluminum $_2O_3$, 10 to 90% of the weight of SiO_2 , and 5 to 40% of the weight of P_2O_5 , silicon, and an aluminum oxide.

Another example of this invention is a process for preparing such a catalyst constituent that comprised an amorphous solid solution of phosphorus, silicon, and an aluminum oxide, This process comprises calcining of that particle for obtaining the amorphous solid solution of gelling of that mixture for the mixture of alumina hydrosol, silica hydrosol, and a phosphorus compound preparing, and creating particles and phosphorus, silicon, and an aluminum oxide. Another example of this invention is the process of acquiring the output by which contacted hydrocarbon to the catalyst complex under hydrocarbon conversion conditions, and hydrogen conversion was carried out, This catalyst complex comprises the phosphorus, silicon, and the aluminum oxide containing 5 to 50% of the weight of aluminum $_2O_3$, 10 to 90% of the weight of SiO_2 , and 5 to 40% of the weight of P_2O_5 .

[0005]

[Means for Solving the Problem]Generally, a constituent by this invention is prepared by

creating a mixture made with alumina sol, silica and sol, and a phosphorus compound. Alumina sol is known well conventionally and prepared by usually carrying out digestion at flowing-back temperature of the range of 80 to 105 °C in strong acid, such as chloride liquid. A range of a ratio of aluminum versus chlorine within this sol is 0.7:1 to 1.5:1 in a weight base. Silica sol is also known well conventionally and it is usually prepared by acidifying water glass. This mixture also contains a phosphorus compound. A typical thing among phosphorus compounds which can be used by this invention H_3PO_4 , H_3PO_2 , H_3PO_3 , $H(NH_4)_2PO_4$, $2HPO_4(NH_4)$, K_3PO_4 , K_2HPO_4 , KH_2PO_4 , Na_3PO_4 , Na_2HPO_4 , NaH_2PO_4 , PX_3 , RPX_2 , R_2PX , R_3P , X_3PO , $(XO)_3PO$, $(XO)_3P$, R_3PO , R_3PS , RPO_2 , RPS_2 , $RP(O)$ and $(OX)_2$, $RP(S)$ and $(SX)_2$, and $R_2P(O)OX$ and $R_2P(S)SX$, $RP(OX)_2$, $RP(SX)_2$, $ROP(OX)_2$, $RSP(SX)_2$, $(RS)_2PSP(SR)_2$, and $(RO)_2ROP(OR)_2$. R is alkyl groups, such as alkyl or a phenyl group, here, and X is hydrogen, R, or a halogenide. As monovalence, these compounds as RPH_2 and bivalence R_2PH . And oxidation phosphine oxidation thing [, such as R_3P , such as butyl phosphorate, and oxidation tributyl phosphine,] R_3PO as tervalence, Tervalence phosphoretted hydrogen sulfide R_3PS , $RP(O)$ of monovalence, $(OX)_2$. And phosphoric acid, such as $R_2P(O)OX$ of bivalence, and benzene phosphoric acid. Corresponding sulfur derivatives, such as $RP(S)$ and $(SX)_2$ and $R_2P(S)SX$, Ester species $(RO)_2P(O)H$ of phosphoric acid, such as dialkyl phosphonate, Dialkyl alkyl phosphonate $(RO)_2P(O)R$, And alkyl dialkyl phosphinate $(RO)P(O)R_2$; Phosphinic acid R_2POX , such as diethylphosphinic acid, The ester species, such as $(RO)P(OX)_2$ of monovalence, $(RO)_2POX$ of bivalence and tervalent $(RO)_3P$, phosphite, and monopropyl ester, Alkyl dialkyl phosphite $(RO)PR_2$ and dialkyl alkyl phosphite $(RO)_2PR$ ester species are contained. $(RS)_2P(S)H$, $(RS)_2P(S)R$, $(RS)P(S)R_2$, R_2PSX , $(RS)P(SX)_2$, and $(RS)_2PSX$, $(RS)_3P$, $(RS)PR_2$, and $(RS)_2PR$. An included corresponding sulfur derivative can also be used. As an example of phosphoric ester, PIROFOSU fights, such as trimethyl phosphite, triethyl phosphite, diisopropyl phosphite, butyl phosphite, and a tetraethyl PIROFOSU fight, are included. An alkyl group of a compound described above contains a carbon atom of 1-4 preferably. As other suitable phosphorus containing compounds, phosphoric acid hydrogen ammonium, phosphorus trichloride, A bromide and an iodine thing, alkyl phosphatization thing $(RO)PCI_2$. There are dialkyl phosphatization thing $(RO)_2PCI$, dialkyl phosphite ghost R_2PCI , dialkyl phosphono chloride $(RO)(R)P(O)Cl$, dialkyl phosphino chloride $R_2P(O)Cl$, and $RP(O)Cl_2$. $(RS)PCI_2$, $(RS)_2PCI$, $(RS)(R)P(S)Cl$, and $R_2P(S)Cl$ are contained in an applicable corresponding sulfur derivative. Desirable phosphorus compounds are phosphoric acid, phosphorous acid, and ammonium phosphate. Before three ingredients of this mixture create that mixture, they may be combined with a semi- mixture. That is, in order to obtain phosphorus refining alumina stated to U.S. Pat.

No. 4,629,717 or U.S. Pat. No. 4,727,209 quoted, this phosphorus compound may be added to alumina sol. Preparation of phosphorus refining alumina sol will process it as it is combined with acidification water glass, i.e., silica sol, and is stated here. Another method mixes use of a phosphorus compound for acidifying water glass, and phosphorus refining silica sol with alumina sol, and a process processed as stated here is included. Finally, a phosphorus compound can be added to the alumina / silica sol prepared in a process indicated to U.S. Pat. No. 3,909,450 quoted. Regardless of how a mixture of these three ingredients is created, Since the mixture provides a final output containing 5 to 50% of the weight of aluminum₂O₃, 10 to 90% of the weight of SiO₂, and 5 to 40% of the weight of P₂O₅, it is required to include sufficient aluminum, silicon, and phosphorus.

[0006]The next step of a process of preparing a complex of this invention includes gelling of a mixture described above. Such one method includes a procedure of making an oil bath or a tower ****(ed) by elevated temperature so that gelling might occur with formation of a spherical particle distributing a combined mixture which makes combining a gelling agent with an above-mentioned mixture, next is created in upper procedure. A gelling agent which can be used in this process is hexamethylene tetramine, urea, or its mixture. A gelling agent is an elevated temperature which fixes or converts a hydrosol ball into a hydrogel ball, and emits ammonia. These balls are continuously taken out from an oil bath next, and in order to improve the physical characteristic further, special aging and a drying process are usually performed in oil and an ammoniacal solution. It is washed and dries at a comparatively low temperature of the range of 93 to 149 ** (200 to 300 degree F), and after that, particles which are made as a result and which were riped and gelled are 454 to 704 ** (850 to 1300 degree F) in temperature, and calcining processing is performed to them for 1 to 20 hours. Thereby, an amorphous solid solution of phosphorus, silicon, and an aluminum oxide is obtained. Aluminum, phosphorus, and a mixture of a silicon component are also gelable by carrying out spray drying of the mixture, or adding a gelling agent to the mixture and carrying out spray drying after that. Spray drying is usually performed under atmospheric pressure (101.3kPa) at temperature of 100 to 760 ** (212 degrees F - 1400 degrees F). Of course, the porous structure of a substance by which spray drying was carried out may not be the same as that of a spheroid-like substance created by an oil droplet method.

[0007]A complex of this invention is characterized as a solid solution of phosphorus, aluminum, and a silicon oxide. That this means means that this complex does not contain an individual phase of alumina, silica, and a phosphorylation thing. Probably, this complex will be best to express it as an alumina matrix replaced with phosphorus and a silicon atom. A fact that it is amorphous means that it has only the arrangement of a short distance and it does not have the arrangement of a long distance related to a crystalline molecular sieve containing silicon, aluminum, and phosphorus. As stated above, it depends for the acidity of this complex on quantity of silica which exists in the complex, therefore the acidity can be controlled by changing quantity of silica in a final complex. this complex has again an average diameter in which that hole is 30 - 300 Å -- a hole -- volume is about 0.35 to 0.75 cc/g, and surface area is

200-420m²/g.

[0008]An amorphous complex by this invention can be used only by it, in order to achieve a catalysis in various hydrocarbon conversion processes, or it is also possible to use as a supporter for distributing catalyst metal. Metal in which activity is shown especially in execution of hydrocarbon conversion processes, such as hydrocracking, isomer-izing, and alkylation, is metal of the group VIB and the group VIII, those combination, or a mixture. Group VIB metal is chromium, molybdenum, and tungsten, and group VII metal is iron, cobalt, nickel, a ruthenium, rhodium, osmium, iridium, and platina *****. Molybdenum, tungsten, nickel, cobalt, and a mixture of these metal are preferred among these metal. Especially a desirable thing is a catalyst containing nickel and tungsten. Concentration of these metal changes with each metal considerably in 0.1 to 20% of the weight of the range of a supporter. In particular, when metal is nickel and tungsten, nickel is 0.1 to 3% of the weight of a range, and tungsten exists in 1 to 20% of the weight of the range. These metal can impregnate a supporter with a resolvability salt of these metal, and can be distributed by a means by which it was known well [of calcining after that]. A typical example of a resolvability salt which can be used Chloridation chromium, bromination chromium, Nitric acid chromium, paramo RIBUNDEN acid ammonium, ammonium metatungstate, Ferric chloride, iron bromide, iron nitrate, a cobalt chloride, a cobalt bromide, a cobalt nitrate, Nickel chloride, nickel bromide, ruthenium tetrachloride, rhodium trichloride, nitric acid rhodium, palladium acid, a palladium chloride, a palladium nitrate, osmium tetrachloride, iridium tetrachloride, chloroplatinic acid, and platina tetrachloride *****. The impregnating technique which can be used in metaled decentralization immerses, and contains evaporation and vacuum impregnation. One desirable method of being impregnated is accompanied by use of a steam-jacket rotary drier. An amorphous complex is dipped in a dispersing agent containing a desirable ingredient contained in an impregnation solution and/, or a dryer, and a complex rotates inside by rotating operation of a dryer. Evaporation of a solution in contact with a rotation complex is promoted by hitting steam to a dryer jacket. It dries, and in order to disassemble the metal salt into a metallic oxide after that, calcining of the catalyst complex as a result is carried out at temperature of 450 to 700 **. In some cases, sulfuration [a catalyst complex as a result] is desirable, and much art known conventionally can perform this. For example, the sulfuration [a catalyst complex as a result] by contacting the catalyst to a sulfur content compound containing hydrogen sulfide, carbon bisulfide, mercaptans, a bisulfide, etc. after the one or two or more metal is distributed on a supporter. Temperature of the range of 20 to 200 ** and temperature of the range of 101.3-1480kPa (atmospheric pressure-200psig) are included in conditions [sulfuration / conditions / a catalyst complex]. The continuation mode is more desirable although a batch mode or continuation mode can also perform sulfuration.

[0009]An amorphous complex by this invention can be used as a hydrocarbon conversion catalyst, after distributing catalyst metal remaining as it is or on it. A hydrocarbon conversion process is well known for advanced technology, and Decomposition, hydrocracking, Alkylation of both isomer-izing, aromatic compounds, and isoparaffins, polymer-izing, refining, hydrogenation, dehydrogenation, transalkylation, dealkylation, hydration, drying, hydrogen

treatment, hydrogenation denitrification, hydrodesulfurization, methanation, and syngas A shift process etc. are included. A concrete reaction condition and a type of a raw material which can be used in these processes are well known for advanced technology. For example, U.S. Pat. No. 4,310,440 and U.S. Pat. No. 4,440,871 have indicated conditions of a process described above. Especially an amorphous complex of this invention fits hydrocracking, decomposition, and alkylation (especially aromatic-compounds alkylation) among above quoted processes.

[0010] Conditions of hydrocracking usually include 1200 degrees F (204 to 649 **) of temperature of the range of 600 degrees - 950 degrees F (316 to 510 **) preferably from 400 degrees F. Reaction pressure is the range of 200-3000psig (1480-20786kPa) preferably 3,500 psig (24234kPa) from atmospheric pressure (101.3kPa). Contact time is usually-1 with a 0.1hr top. --1 with 15hr top -- desirable-1 with 0.2 to 3hr top It is equivalent to space speed (LHSV) fluid per hour of *****. hydrogen circulation velocity -- per 1 barrel of raw materials -- 1,000-50,000 standard cubic feet (scf) -- it is the range of 2,000-30,000scf (355-5,333 standard m³/m³) per 1 barrel of raw materials preferably. Relevant hydrogen treatment conditions are within the limits of hydrogenation conditions generally described above. Effluent from reaction zones is usually taken out from a catalyst bed, receives partial concentration and steamy-liquid separation, and it is classified in order to collect the various ingredients after that. It returns to some heavier uncollected substances, and hydrogen and when desirable, all return to a reactor. Quality of non-salvaged material can also be sent to the second reactor using a two-step flow. Even if it uses a catalyst by this invention only in one stage of such a process, it does not interfere, and even if it uses in both reactor stages, it does not interfere.

[0011] A catalyst decomposition process is preferably performed using raw materials for the deasphalting crude oil emainder, such as gas oil and heavy naphtha, etc. using these constituents, and the most important desirable output is gasoline. Temperature of the range of 850 degrees - 1100 degrees F, -1 with a 0.5-10hr top A LHSV value of ***** and pressure conditions of 101.3-446.1kPa (0-50psig) are suitable. Alkylation of aromatic compounds includes aromatic compounds (C₆-C₁₂) and a process of making especially benzene reacting to a monoolefin and building straight-line alkylation aromatic compounds. this process -- aromatic-compounds [of the range of 5:1 to 30:1]: -- an olefin (for example, benzene: olefin) -- a ratio and-1 with a 0.3-6hr top It performs by temperature of ** LHSV and 100 degrees - 250 **, and a pressure of 1480-6996kPa (200-1000psig). Still more detailed information about a device can be seen to U.S. Pat. No. 4,870,222 quoted by this specification.

[0012]

[Example]

Some constituents having contained only example 1 phosphorus, silicon and aluminum, or silicon and aluminum were built. The following procedures were used in order to prepare these samples.

In order that the metallic aluminum in which the weight ratio of aluminum:Cl contains polymer nature chloridation alumina HIDOROKISHI by 0.88 (aluminum: 12.5 % of the weight) might build hydrosol, digestion was carried out within diluent salt acid at the temperature of 102 **.

Then, the quantity of the phosphoric acid calculated in order to make into a specific value phosphorus content of the spherical particle to which each calcining of [other than the particles used as control] was carried out was applied to hydrosol. In each experiment, in order to maintain alumina and an aluminum phosphate solid quantitative formula in 25-30% of range, a suitable quantity of water was added. Next, it was mixed with hexamethylenetetramide (HMT) solution, in order that each hydrosol containing phosphorus might be cooled and the mole ratio of HMT:Cl might build the hydrosol of 0.4.

The mole ratio of Cl:Na added the concentration HCl to dilution-water glass so that 1, 10, and SiO₂ concentration might be 11%, and it created acidification water glass. Next, phosphorus content alumina sol was added to the acidification water glass, and the acidic solution containing phosphorus, alumina, and silica hydrosol was created. Hydrosol was formed in the spherical hydrogel particle by emitting hydrosol as a drop in the dropping tower which contains an oil suspension medium at the temperature of 95 **. This spherical hydrogel particle was ripened by a part of gas oil under the temperature of 100 ** for 19 hours. A spherical particle is rinsed under the temperature of 95 ** after maturation treatment.

Then, it was made to dry under the temperature of 120 ** for 2 hours.

Finally, amorphous silica / alumina / phosphate spherical particle was calcined under existence of moist air (3%H₂O) at the temperature of 650 ** for 2 hours. The attribute of the spherical

particle created in the procedure described above is shown in Table 1.

[0013]

[Table 1]

球状粒子の特性

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>サンプル</u>				
重量%P ₂ O ₅	0	0	30	13
重量%Al ₂ O ₃	50	25	28	27
重量%SiO ₂	50	75	42	60
X線フーズI.D.	746771	746771	746771	746771
表面積 (m ² /g)	336	372	257	308
孔体積 (cc/g)	0.68	0.84	0.81	0.54
孔直径 (Å)	81	88	127	71
A B D	0.52	0.82	0.49	0.64

[0014]Nickel and tungsten salt were impregnated with the spherical particle which two examples prepared by 1, and the hydrocracking catalyst was created. The ammonium metatungstate of a suitable quantity and nickel nitrate were melted in pure water, and it put into the stream jacket rotary drier. 120 g of desirable spherical particles stated to this solution in Example 1 were added, that mixture was rotated for 30 minutes at the room temperature, the steam was applied to the rotary drier after that, and excessive moisture was evaporated thoroughly. The nickel/W catalyst particle created as a result is calcined at 240 ** for 1 hour. Then, it calcined at 565 ** for 2 hours.

It was sent through the furnace for calcining at a rate of 0.056-m³ per hour (1.5 cubic feet) among this calcining. The presentation of the catalyst created eventually is shown in Table 2.

[0015]

[Table 2]

<u>サンプル</u>	<u>触媒の特性</u>			
	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
ベースNo.	1	2	3	4
A B D	C.71	0.76	0.57	0.75
% N i	C.6	1.0	0.67	0.57
% W	6.0	10.0	6.65	5.27

[0016]The catalyst created by two in three examples was tested using the pilot plant using light ARABIAN VGO which is a crude oil with the following attributes.

Specific gravity Relative density in 0.9206@60 degrees F or 15 ** The first boiling point 354 ** (670 degrees F)

10% 443 ** (830 degrees F)

20% 454 ** (849 degrees F)

30% 460 ** (860 degrees F)

40% 471 ** (879 degrees F)

50% 482 ** (900 degrees F)

60% 492 ** (917 degrees F)

70% 501 ** (933 degrees F)

80% 513 ** (955 degrees F)

90% 526 ** (979 degrees F)

The last boiling point 553 ** (1027 degrees F)

Each catalyst was tested by the following test conditions.

Test-condition plant pressure 13891kPa (2000psig)

-1 with a LHSV 1.0hr top CFR 1.0 recycling H_2 1780m³/m³ (FF with the bottom of 10,000SCFB))

Each activity result of the tested catalyst is shown in Table 3.

[0017]

[Table 3]

テストされた触媒の活性

<u>触</u> <u>媒</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
温度	416℃ (781°F)	417℃ (783°F)	423℃ (801°F)	418℃ (784°F)
12時間で288℃(550°F)への転化	85	80	71	80
62時間で(288℃)550°Fへの転化	64	70	66	76
ケロシン収率				
重量% 149-288℃(300-550°F)				
288℃(550°F)への80%転化	45	42	---	45
288℃(550°F)への70%転化	41	39	48	---

総液体収量

<u>触</u> <u>媒</u>	<u>6</u>	<u>8</u>
371℃への転化 重量%	94	94
総液体収量	86.7	87.9
C ₆ -149℃(C ₆ -300°F)(ガソリン)	28.4	26.3
149-288℃(300-550°F)(軽油)	44.4	44.7
288-371℃(550-700°F)(ディーゼル)	13.9	16.9

The test result shown in Table 3 shows clearly the advantage of the catalyst created by silica / alumina / phosphorus solid solution supporter. This is shown by the height of that the rate of deactivation of a phosphorus containing composition is low, and kerosene yield.

[0018]

[Effect of the Invention]The catalyst complex which consists of the phosphorus of this invention, silicon, and an aluminum oxide amorphous solid solution is a new useful catalyst used for hydrocracking of hydrocarbon, isomerization, alkylation, etc. as a supporter of the metal of catalytic activity itself or on it.

[Translation done.]